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Geoinformation Tools in the Evaluation of River Renaturation Projects in the Czech Republic

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Geoinformation tools (GIT) allow for the identification of historical and current riverbeds and previous anthropogenic interventions to river systems. Due to the decreasing costs of high-precision data acquisition and the necessary hardware, GIT has become a standard tool for monitoring the fluvial dynamics of watercourses.

Czech rivers have long been influenced by human activity. The most significant engineering interventions were carried out during the 20th century, driven by efforts to maximize agricultural land use and ensure flood protection. Over the past two decades, efforts to remediate these impacts have emerged on a small portion of Czech rivers, primarily in the form of "revitalization". This involves constructing new channels using more natural materials, such as stone instead of concrete

The Nature Restoration Regulation (NRR, adopted in June 2024) requires that by 2030, at least 25,000 kilometres of free-flowing rivers be restored in EU countries compared to 2020 levels. This requires identifying and removing artificial structures to restore the natural functions of watercourses and enhance sediment erosion and deposition. Most modifications to Czech rivers have focused on stabilizing flows and river banks, preventing flooding, enabling farming, and ensuring sustainable water use for human needs. However, those aims are not compatible with NRR's concept of free-flowing rivers. Recently, some "renaturation" projects have attempted to restore river dynamics and functions in the Czech Republic. These projects remain in the minority due to the societal inertia of over a century of engineering approaches and restrictions on river dynamics.

This contribution presents several examples of recent renaturation projects in the Czech Republic. The first examples are innovative projects on three-kilometre-long sections of two headwater streams in the Ore Mountains. From 2009 to 2010, the previously channelized stream was reconstructed in a meandering pattern following former revitalisation strategy. The recent renaturation project in this area began in August 2023 and ended in April 2024. It began with the

decommissioning and backfilling former, deeply incised, artificial channels to allow the water to create its own paths and to support of a self-evolving channel - an approach fully compatible with NRR objectives. Another project was implemented on a five-kilometre section of a Czech lowland river. There, an embankment was transformed into near-natural banks with artificial channel bars and side arms.

We used a LiDAR-equipped drone to generate digital terrain models (DTMs) and a full-frame camera to produce high-resolution orthomosaics to monitor the restoration of channel dynamics. We subsequently used this data for morphological and hydrological analyses by the ArcGIS (Esri) software. Field surveys were also conducted. To evaluate the restoration of channel dynamics, the headwater streams were monitored four times a year for two years, and the lowland river was monitored three times a year for two years. The monitoring demonstrated success with renaturation of the headwater streams. However, the modifications to the lowland river were more robust, so significant channel dynamics did not manifest within the two-year evaluation period. The results show viable pathways to meet the NRR requirements.